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IS 12699 (1989): Selection, installation, operation and maintenance of centrifugal jetl pump - Code of practice [MED 20: Pumps]

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Indian Standard

SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF JET CENTRIFUGAL PUMP COMBINATION — CODE OF PRACTICE

भारतीय मानक

जेट अपकेन्द्री पंप कंविनेशन के चयन, संस्थापन,
परिचालन और रखरखाव – रीति संहिता

UDC 621·671 : 621·694 : 006·76

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

November 1989

Price Group 3

Pumps Sectional Committee, HMD 20

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 12 June 1989, after the draft finalized by the Pumps Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This standard has been prepared on the basis of information received from industry. The technical requirements are covered in IS 12225 : 1987 'Jet centrifugal pump combination'.

AMENDMENT NO. 1 JANUARY 1997
TO
IS 12699 : 1989 SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF JET CENTRIFUGAL PUMP COMBINATION — CODE OF PRACTICE

(*First cover page and page* 1, *title*) — Substitute the following for the existing title:

'SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF CENTRIFUGAL JET PUMP — CODE OF PRACTICE'

Also substitute 'Centrifugal jet pump' *for* 'jet centrifugal pump combination' wherever appear in this standard.

(*Page* 1, *clause* 3.0) — Substitute the following for the existing matter:

'3.0 The selection criteria are listed below:

a) Water well size and capacity,

b) Maximum depth from which water is lifted,

c) Performance requirements, namely, quantity, jet setting depth and discharge head (delivery head of centrifugal pump),

d) Type of prime mover,

e) Type of installations, and

f) Quality of water.'

(*Page* 1, *clause* 3.1.2) — Substitute the following for the existing clause:

'3.1.2 *Bore Well*

In bore wells, the sizes of pipe lines depend on the diameter of the bore. For the same bore well, if more quantity of water is to be pumped, in order to accommodate bigger flow area for the pressure pipe and delivery pipe (suction pipe of centrifugal pump) of the jet pump (assembly) packer/duplex type of jet pumps (assemblies) are preferred to twin type jet pumps (assemblies). In all bore wells for ease of erection, maximum jet unit outer dimension shall be always 6 mm (minimum) less than the clear bore well size. The maximum quantity of water that can be pumped by using these jet pumps (assemblies) with optimum percentage loss of friction in both pressure and delivery pipes (suction pipe of centrifugal pump) of the jet pumps (assemblies) shall be as given in Tables 1 and 2.'

(*Page* 1, *Table* 1, *column headings*) — Substitute '**Jet Pump (Assembly) Maximum Dimension**' *for* '**Jet Pump Maximum Dimension**', '**Delivery Pipe (Suction Pipe of Centrifugal Pump) Diameter**' *for* '**Discharge Pipe**' and '**Pressure Pipe Diameter**' *for* '**Pressure Pipe**'.

(*Page* 1, *Table* 2, *column headings*) — Substitute '**Inner Pipe (Suction Pipe of Centrifugal Pump) Diameter**' *for* '**Discharge Pipe Diameter**'.

(*Page* 2, *clause* 3.2, *sixth line*) — Substitute 'IS 210 : 1993' *for* 'IS 210 : 1978'.

(*Page* 2, *clause* 3.3.1) — Substitute 'Quantity' *for* 'Quality' wherever appears in the clause.

(*Page* 2, *clauses* 4 *and* 5) — Designate clauses '4' and '5' as '3.4' and '3.5' and renumber the subsequent clauses.

[*Page* 2, *clause* 4 (b)] — Substitute the following for the existing matter:

'b) *Electric Motor*, shall be according to IS 996 : 1979 for single phase and IS 7538 : 1975 for three phase.'

(*Page* 2, *clause* 6.1, *last sentence*) — Substitute the following for the existing sentence:

'Further the pipe tapping to the jet pump (assembly) shall be provided in the centrifugal pump casing itself.'

(*Page* 2, *clause* 6.1) — Insert the following note at the end:

'NOTE — Typical field installations for twin type centrifugal jet pump, packer type centrifugal jet pump, and duplex type centrifugal jet pump are given in Fig. 1, Fig. 2 and Fig. 3 respectively.'

(*Page* 2, *clause* 6.1.1, *first and third lines*) — Insert the words 'pump (assembly)' after the word 'jet'.

(*Page* 2, *clause* 6.2) — Substitute the following for the existing:

'6.2 Installation of Twin Type Centrifugal Jet Pump (*see* Fig. 1)

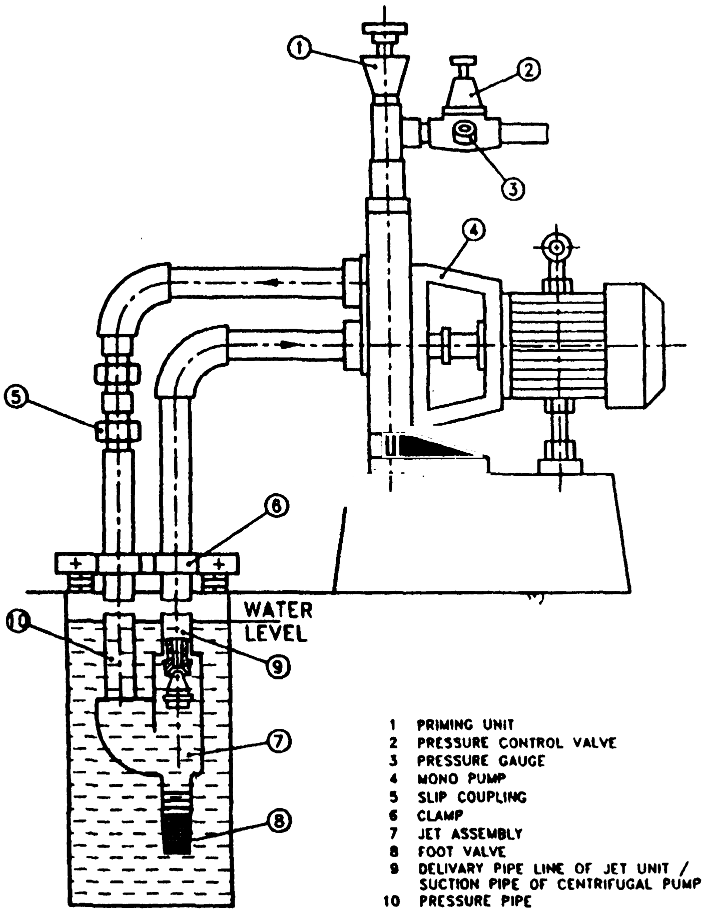

FIG. 1 TYPICAL FIELD INSTALLATION FOR TWIN TYPE JET CENTRIFUGAL PUMP COMBINATION

(*Page* 2, *clause* 6.2.1, *second sentence*) — Substitute the following for the existing sentence:

'Air shall be blown through the jet assembly to ensure that no dirt or foreign particles are trapped inside.'

(*Page* 2, *clause* 6.2.2) — Substitute the following for the existing clause:

'6.2.2 *Pipe Assembly*

Clean all pipes from foreign particles before tightening with jet pump (assembly). Tighten the delivery (suction of centrifugal pump) and pressure pipes, applying suitable pipe compound to the proper threads with the jet pump (assembly). While tightening the delivery pipe (suction of centrifugal pump) care shall be taken to see that it does not on any account strike the protruding portion of the venturi tube. Do not overtighten the pipe in the jet body and while tightening the pressure pipe do not move away the two pipes too much as both the above actions may lead to breakage of the jet assembly. After tightening each length pour water and see that there is no leakage in the joints. A chain block of minimum two tonne capacity with tripod consisting of 6-metre long 50-mm dia pipes, can be used for deep well erection. The delivery (suction of centrifugal pump) and pressure pipes shall be clamped with proper size clamp securely, and while one clamp is for lowering (or lifting), the nuts of the other clamp be loosened and positioned in the proper place and secured to fit the chain block hook for the subsequent operation. Tighten each end of pipe length by a binding wire to avoid damage to the jet assembly due to pipe chattering during subsequent pipe tightening. When the pipes have been fitted up to full length, fit two elbows with the delivery (suction of centrifugal pump) and pressure pipes with the proper centre distance between the pipes and fit them to the delivery (suction of centrifugal pump) and pressure pipe lines in the common flange of the centrifugal pumpset. The slip coupling in the pressure pipe line (*see* Fig. 1) facilitates easy erection. Then insert the slip coupling in the pressure line such that the cut is in the centre of the coupling. Then tighten pump common flange without any leakage with a rubber washer to the pump body. In vertical mounting fit directly the delivery pipe (suction of centrifugal pipe) to the common flange and assemble the slip coupling in the pressure pipe line vertically. For horizontal mounting the slip coupling can be conveniently fitted in the horizontal portion of the pressure pipe line.'

(*Page* 3, *clause* 6.2.3) — Substitute the following for the existing:

'6.2.3 *Assembly of Discharge Pipe (Delivery of Centrifugal Pump) to the Monopump*

Fit the discharge (delivery of centrifugal pump) flange to the pump body using the rubber washer. To the discharge flange (delivery of centrifugal pump) using a nipple, tighten a T-coupling. To the top of the T-coupling, tighten the priming unit. To the other side, tighten the pressure regulating valve. Connect the discharge line (delivery of centrifugal pump) to the overhead tank on the other side of the pressure regulator valve. The arrow mark on the valve body shall point toward the direction of the flow of water in the discharge line (delivery of centrifugal pump). Tighten the delivery (suction of centrifugal pump) and pressure pipe lines in the horizontal portion by a twin clamp before starting. Give a proper support to the pipe lines so that they do not give any pressure on the pump body. Screw down the pressure guage to the threaded opening provided in the pump casing/pressure regulator valve body.'

(*Page* 3, *clause* 6.3) — Substitute the following for the existing clause:

'6.3 Installation of Packer Type Cetntrifugal Jet Pump (*see* **Fig. 2)**

The main components of packer type jet centrifugal pump combination are:

a) Centrifugal monoblock pump/coupled pump/belt driven pump;

b) Jet assembly components:

   1) Packer type jet assembly with foot-valve, packer and strainer assembly,

   2) Packer housing contained in a sealing pipe with stopper coupling,

   3) Packer head/well adopter,

   4) Flanges to connect pump and packer head, and

   5) Clamps for outer pipe, inner pipe and well.

c) Discharge (delivery of centrifugal pumps) assembly components:

   1) Pressure regulating valve,

   2) Priming unit,

   3) Pressure gauge,

4) Air releasing cock, and

5) Discharge flange (delivery of centrifugal pump).

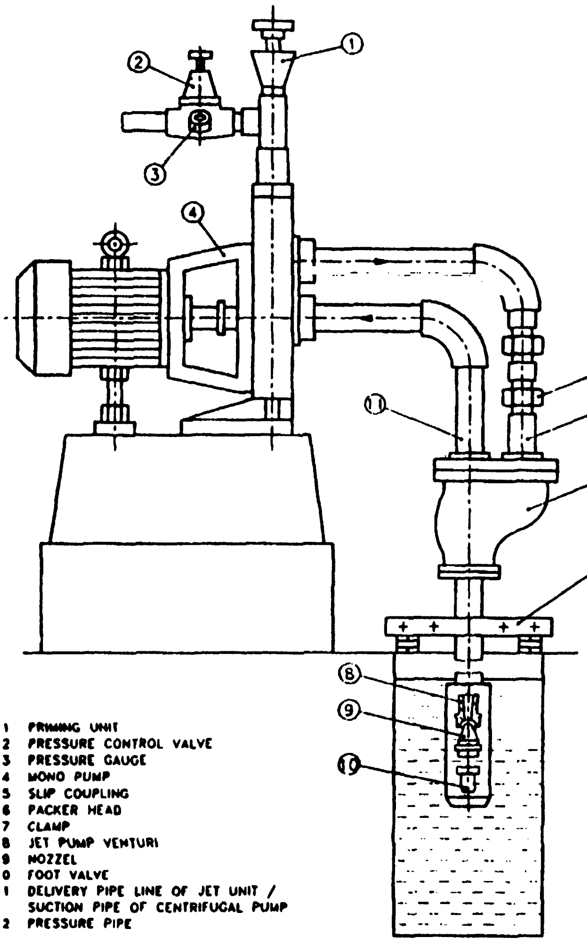

FIG. 2 TYPICAL FIELD INSTALLATION FOR PACKER TYPE JET CENTRIFUGAL PUMP COMBINATION

(*Page* 3, *clause* **6.3.2**) — Substitute the following for the existing clause:

'**6.3.2** *Assembly of Inner Pipe to the Jet Assembly and Locating it Within the Outer Pipe*

All the jet assemblies fitted with foot-valve, packer assembly and a strainer are to be tested for proper operation before leaving the works. The complete assembly of jet, foot-valve, packer assembly and strainer are to be supplied as a single unit. They contain two bucket washers at the bottom fitted to the packer assembly. Screw down the packer jet assembly to the first length of inner pipe by using proper pipe compound so that there shall not be any leakage. During the operation, care shall be taken to see that the pipe is clean. During tightening operation, the bucket washer shall not be allowed to touch any surface which will lead to their damage. Lower the inner pipe with jet assembly into the outer pipe so that the rubber packer do not strike the walls of the outer pipe during lowering operation. A good suggestion is to use small lengths after cleaning them thoroughly. Care shall be taken to see that the joints are leakproof. During the tightening operation of successive lengths of inner pipe, the bottom portion of the pipe lowered inside the casing pipe shall not be allowed to turn. As soon as the bottom portion of the jet assembly has touched the stopper coupling, see that the inner pipe protrudes above the outer pipe flange by 0.2 m. At the top, inner pipe shall not be threaded. Do not allow the inner pipe or jet assembly to strike the stopper couplings suddenly. This may lead to damage of the complete unit itself. Use chain block with tripod to lower the inner pipe.'

(*Page* 4, *clause* **6.3.3**, *line* 2) — Delete the word '(delivery)'.

(*Page* 4, *clause* **6.3.3**) — Insert the following Note at the end:

'NOTE — The inner pipe becomes the suction line of the centrifugal pump annular space between the inner and outer pipes functions as pressure pipe line.'

(*Page* 4, *clause* **6.3.4**) — Substitute the following for the existing matter:

'**6.3.4** *Assembly of Discharge (Delivery of Centrifugal Pump) Pipeline to the Monopump*

See **6.2.3** for details.'

(*Page* 4, *clause* **6.4**) — Substitute the following for the existing heading:

'**6.4 Installation of Duplex Type Jet Pump (*see* Fig. 3)**'

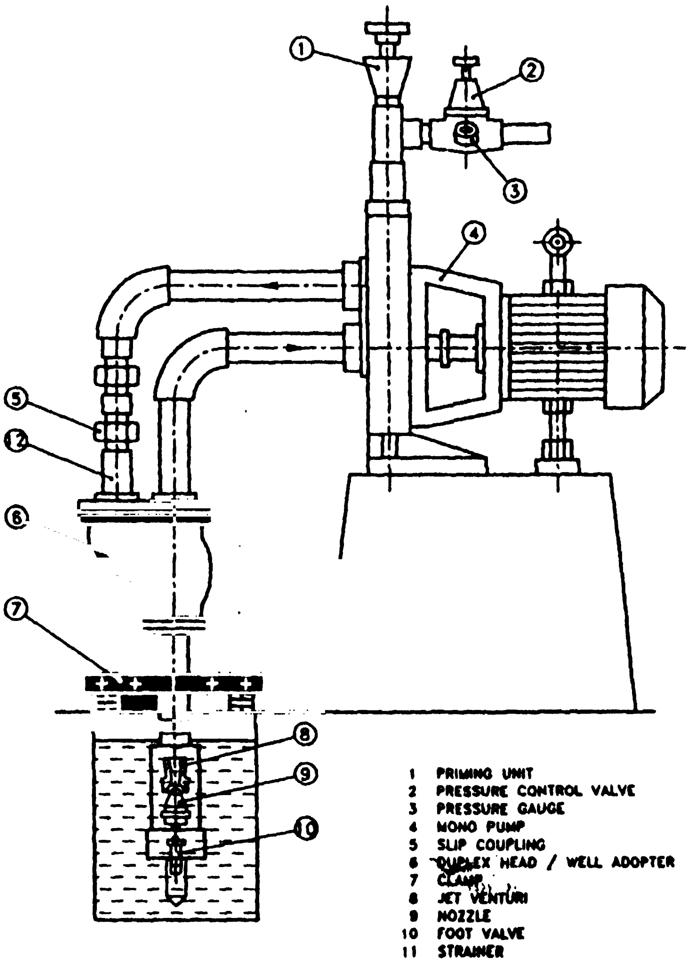

FIG. 3 TYPICAL FIELD INSTALLATION FOR DUPLEX TYPE JET CENTRIFUGAL PUMP COMBINATION

[*Page* 4, *clause* **6.4.1**(a)] — Substitute the following for the existing matter:

'a) Assembly of outer pipe and inner pipe to the duplex jet assembly,'

[*Page* 4, *clause* **6.4.1**(c)] — Substitute the following for the existing matter:

'c) Assembly of discharge line (delivery of centrifugal pump).'

(*Page* 4, *clause* **6.4.2**, *para* 1, *line* 4) — Substitute 'inner' *for* 'delivery'.

(*Page* 5, *clause* **6.4.3**, *heading*) — Substitute '*Inner*' *for* '*Delivery*'.

(*Page* 5, *clause* **6.4.3**, *line* 2) — Delete '(delivery)'.

(*Page* 5, *clause* **6.4.3**) — Insert the following Note at the end:

'NOTE — The inner pipe becomes the suction line of the centrifugal pump and the annular space between the inner and outer pipes functions as pressure pipe line.'

(*Page* 5, *clause* **6.4.4**) — Substitute the following for the existing clause:

'**6.4.4** *Assembly of Delivery Pipeline to the Monopump*

see **6.2.3** for details.'

(*Page* 6, *clause* **8.1**, *first line*) — Substitute 'maintenance requirements' *for* 'installations'.

(*Page* 6, *Annex* A) — Substitute 'IS 210 : 1993 Grey iron castings (*fourth revision*)' *for* 'IS 210 : 1978 Grey iron castings (*third revision*)'.

(*Page* 6, *Annex* A) — Insert the following after IS 996 : 1979:

'IS 7538 : 1975	Three phase squirrel cage induction motor for centrifugal pumps for agricultural application'

(HMD 20)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 OCTOBER 2007
TO
IS 12699 : 1989 SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF JET CENTRIFUGAL PUMP COMBINATION — CODE OF PRACTICE

(*First cover page*) — Substitute the following for the existing Hindi title:

'जेट अपकेन्द्री पंप के चयन, संस्थापन एवं प्रचालन
और रखरखाव - रीति संहिता'

(ME 20)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF JET CENTRIFUGAL PUMP COMBINATION — CODE OF PRACTICE

1 SCOPE

1.1 This standard lays down general guidelines for selection, installation, operation and maintenance of twin, duplex and packer type jet centrifugal pump combinations.

2 REFERENCES

2.1 The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 SELECTION CRITERIA

3.0 The selection criteria are listed below:

a) Water well size, capacity, and depth;

b) Performance requirements, namely, quantity, jet setting depth and discharge head;

c) Type of prime mover;

d) Types of installations; and

e) Quality of water.

3.1 Water Well Size, Capacity and Depth

3.1.1 *Open Well*

In open wells, there is no restriction on selection of pipe size for the jet centrifugal pump combination.

3.1.2 *Bore Well*

In bore wells, the size of pipe lines depends on the diameter of the bore. For the same bore well, if more quantity of water is to be pumped, in order to accommodate bigger flow area for the pressure pipe and delivery pipe of the jet pump, packer/duplex type of jet pumps are preferred to twin type jet pumps. In all bore wells for ease of erection, maximum jet pump outer dimension shall be always minimum 6 mm less than the clear bore well size. The maximum quantity of water that can be pumped by using these jet pumps with optimum percentage loss of friction in combined pipe line of pressure and delivery of pump shall be as given in Tables 1 and 2.

Table 1 Dimensions and Maximum Output for Twin Type Jet Pump

(*Clause* 3.1.2)

Clear Bore Diameter	Jet Pump Maximum Dimension	Discharge Pipe	Pressure Pipe	Maximum Recommended Output
mm	mm	mm	mm	l/m
80	76	25	20	12
100	92	32	25	20
110	102	40	32	35
125	114	40	40	50
150	126	50	40	65
150	135	50	50	80
200	164	65	50	120
200	172	65	65	180
200	185	80	65	225
250	230	100	80	320

NOTE — The discharges indicated are for an optimum combined pipe friction of about 10 percent. By allowing higher frictional losses, more output can be obtained.

Table 2 Dimensions and Maximum Output for Packer/Duplex Type Jet Pumps

(*Clause* 3.1.2)

Clear Bore Diameter	Outer Pipe Socket Diameter	Discharge Pipe Diameter	Outer Pipe Diameter	Maximum Recommended Output
mm	mm	mm	mm	l/m
80	70	25	50	15
100	89	40	65	35
100	96 (TC)*	50	80	75
110	102	50	80	75
125	102	50	80	75
125	122 (TC)*	65	100	170
150	127	65	100	170
150	147 (TC)*	80	125	250
200	159	80	125	250

*(TC) means turned coupling.

3.2 Quality of Water

The quality of water shall be taken into consideration for selection of jet pump and centrifugal pump components construction. When pumped water is neutral, the jet pump shall be made of cast iron (Minimum Grade FG 200 of IS 210 : 1978). When the water is acidic, jet pump and impeller of centrifugal pump shall be bronze as per Grade LTB2 of IS 318 : 1981.

3.3 Performance Requirements

3.3.1 *Quality*

The quality of water required shall be decided by two factors:

a) Actual consumer requirement, and

b) Availability of yield of well or bore well.

The maximum quantity that may be tapped shall be 80 percent of the tested yield of the well.

3.3.2 *Jet Setting Depth*

To take care of frictional losses, the jet setting depth shall be taken 1·2 times the optimum spring depth of the bore well and jet pump shall be placed 3 to 5 m above the bottom of the bore well for silt not to enter the jet pump and it shall be placed 2 m below the maximum drawn down level or to have adequate submergence as specified by manufacturer.

3.3.3 *Discharge Head*

The discharge head of the jet centrifugal pump combination shall be almost near the minimum operating head of the system which generally is taken as operating head of the centrifugal pump minus 6 m. This shall allow the system to operate at the optimum efficiency.

4 TYPE OF PRIME MOVER

Jet centrifugal pump combination shall be selected according to the availability of the power source.

a) *Diesel Engine*, shall be according to IS 11170 : 1985.

b) *Electric Motor*, shall be according to IS 996 : 1979.

NOTE — If jet centrifugal pump combination is to be driven by both, belt driven type centrifugal pump shall be preferred. If the pump is to be driven by only electric source, monobloc or direct coupled pump shall be preferred.

5 TYPES OF INSTALLATIONS

a) *Vertical*

Whenever the centrifugal pump is to be placed in a separate room away from well, horizontal installation is preferred and whenever space availability is limited and where pump has to be placed above the well, vertical mounting of the centrifugal pump shall be preferred.

b) *Horizontal*

When centrifugal pump is mounted horizontally, the length of the horizontal pipe line shall not be more than 1·5 to 2 m. In case the lengths are to be increased, one size higher diameter of pipe shall be used to keep the frictional losses minimum.

6 INSTALLATION

6.1 Installation of Centrifugal Pump

All requirement laid down in IS 9694 (Part 2) : 1980 shall apply to the centrifugal pump. (For simplicity, the centrifugal pump of the system has been taken as a motorized monobloc horizontal type centrifugal pump). The entire installation is given for pumps with flange ends; for screwed ends, the procedure is the same except that the pipes are screwed in and jointed with union joints slip coupling. Further, the pipe tapping to the jet pump shall be provided in the centrifugal pump casing itself in the example considered.

6.1.1 *Plumbing the Well*

Before erecting the jet inside the borewell, lower a guide of outer diameter 6 mm bigger than the outer pipe coupling/jet diameter with a minimum length of 2 m into the borewell. It shall be noted that it goes into the borewell freely. At every 3 m interval, a knot shall be tied in the inserting rope to find out the water depth. A yield test conducted in the bore with test pump will also help to assess the maximum length of pipe to be lowered.

6.2 Installation of Twin Type Jet Centrifugal Pump Combination

6.2.1 *Inspection*

All components before erection, shall be inspected for possible damage in transit. No dirt or foreign particles entrapped inside shall be seen by blowing air through jet assembly combination. Pour water inside the jet assembly up to pressure pipe housing level and find out whether there is any leakage in the jet body or the foot valve. If there is any leakage in the foot-valve where it is threaded with the jet assembly, tighten them with suitable pipe compound and thread packing. Over tightening will result in breakage.

6.2.2 *Pipe Assembly*

Clean all pipes from foreign particles before tightening with jet pump. Tighten the delivery and pressure pipe, applying suitable pipe compound to the proper threads with the ejector body. While tightening the delivery pipe, care shall be taken to see that it does not on any account strike the protruding portion of the venturi tube. Do not over-tighten the pipe in the jet body and while tightening the pressure pipe, do not move away the two pipes too much as both the above will lead to breakage of jet assembly. After tightening each length, pour water and see that there is no leakage in the joints. A chain block of minimum two tonne capacity with tripoid each of 6 m length of 50 mm pipe can be used for deepwell erection. Each pipe shall be used clamped with proper size clamp securely, and while one clamp is used for lifting or lowering, the other nuts be loosened and positioned in the proper place and secured to fit the chain block for the subsequent operation. Tighten each end of pipe length by a binding wire to avoid damage to the jet assembly due to pipe chattering during subsequent pipe tightening. When the pipes have been fitted up to full length, fit two elbows with the delivery and pressure pipes with the proper centre distance between the pipes and fit them to the delivery and pressure pipe lines in the flanges. The slip coupling in the pressure pipe line facilitates easy erection. Make a central cut in the horizontal length of the pressure pipe line, then insert the slip coupling in the pressure line such that the cut is in the centre of the slip coupling. Then tighten the slip coupling nuts to seal the pressure line from leakage. Tighten pump common flange without any leakage with a rubber washer to the pump body. In vertical mounting, fit directly the delivery pipe to the common flanges and assemble the slip coupling to the pressure pipe vertically.

6.2.3 *Assembly of Discharge Pipe to the Monopump*

Fit the discharge flange to the pump body using the rubber washer and wire gauge to avoid entry of foreign particles. To the discharge flange using a nipple, tighten a T-coupling. To the top of the T-coupling, tighten the priming unit. To the other side, tighten the pressure regulating valve. Connect the discharge line to the overhead tank on the other side of the pressure regulator valve. The arrow mark on the valve body shall point towards the direction of the flow of water in the discharge line. Tighten the delivery and pressure pipe lines in the horizontal portion by a twin clamp before starting. Give a proper support to the ejector pipeline so that they do not give any pressure on the pump body.

6.3 Installation of Packer Type Jet Centrifugal Pump Combination

The main components of packer type jet centrifugal pump combination are centrifugal monobloc pump/coupled pump/belt driven pump.

Jet Assembly Components

a) Packer type jet assembly with foot-valve, packer and strainer assembly;

b) Packer housing contained in a sealing pipe with stopper coupling;

c) Packer head/well adopter;

d) Flanges to connect pump and packer head;

e) Clamps for outer and inner pipe, well; and

f) Delivery assembly components:

   1) Pressure regulating valve,
   2) Priming unit,
   3) Pressure gauge,
   4) Air releasing cock, and
   5) Delivery flanges.

6.3.1 *Outer Pipe Assembly*

The packer housing which forms the bottom most part of the outer pipe is always supplied with a screwed in stopper coupling. Clean the packer housing and see that the stopper coupling contains within it, a shock absorbing disc pasted to it. Then screw down the packer housing to the first length of outer pipe through a coupling firmly applying suitable pipe compounds. During the tightening operation, care must be taken to see that either the packer housing or the outer pipe does not collapse due to the excessive or improper tightening pressure. Lower first length inside the bore gently without striking the walls of the bore. Connect through couplings up to the required length, successive bits of outer pipe to the first length. On the top of the last bit of the outer pipe, tighten the outer pipe flange and place above the bore well or open well, using a clamp on a bed, which may be bore casing pipe in borewells, or a platform of rails in open wells. For lowering the outer pipe within the bore well, a chain block mounted on a tripoid post must be used. Each length of outer pipe must be checked for correct bore sizes and for bends, by passing through it a guide of the specified outer pipe bore size. Any burrs or welding lines inside the outer pipe protruding above the specified bore size shall be removed and then only the pipe shall be used for erection.

6.3.2 *Assembly of Inner (Delivery) Pipe to the Jet Assembly and Locating it Within the Outer Pipe*

All the jet assemblies fitted with foot-valve, packer assembly and a strainer are to be tested for proper operation before leaving the works. The complete assembly of jet, foot-valve, packer assembly and strainer are to be supplied as a single unit. They contain two bucket washers at the bottom fitted to the packer assembly. Screw down the packer jet assembly to the first length of delivery pipe by using proper pipe compound so that there shall not be any leakage. During the operation, care shall be taken to see that the pipe is clean. During tightening operation, the bucket washer shall not be allowed to touch any surface which will lead to their damage. Lower the delivery pipe with jet assembly into the outer pipe so that the rubber packer do not strike the walls of the outer pipe during lowering operation. A good suggestion is to use small lengths after cleaning them thoroughly. Care shall be taken to see that the joints are leakproof. During the tightening operation of successive bits of delivery pipe, the bottom portion of the pipe lowered inside the casing pipe shall not be allowed to turn. As soon as the bottom portion of the jet assembly has touched the stopper coupling, see that the delivery pipe protrudes above the outer pipe flange by 0·2 m. At the top, delivery pipe shall not be threaded. Do not allow the delivery pipe or jet assembly to strike the stopper couplings suddenly. This may lead to damage of the complete unit itself. Use chain block with tripoid to lower the delivery pipe.

6.3.3 *Assembly of Outer and Delivery Pipe to the Monopump Through Packer Head and Flanges*

The concentric flow areas between outer and inner (delivery) pipes are made twin flow areas by fitting a packer head above the outer pipe flange. Place its gasket above the outer pipe flange and then mount the packer head above it, passing it above the inner pipe outside diameter. In this condition, the inner pipe shall be protruding above the packer headtop level by at least 40 to 50 mm. Cut the inner pipe using hacksaw to the top surface level of packer head. Clean out all the burrs around the inner pipe and insert the sealing ring rubber gland above the outside diameter of the inner pipe which will sit in its seating in the packer head. Place its gasket above the packer head, now it is ready for connecting with the monopump. Two sets of flanges one for the packer head and other for monopump shall be supplied. Connect these flange using two elbows and required length of pipes. A slip coupling may be used for the ease of erection in the pressure line. Using the gasket, tighten this assembly to the packer head and monopump.

6.3.4 *Assembly of Discharge Pipeline to the Monopump*

Fit the discharge flange to the pump body using the rubber washer and wire gauge to avoid entry of foreign particles. To the discharge flange using nipple, tighten a T-coupling. To the top of the T-coupling, tighten the priming unit. To the outer side, tighten the pressure regulating valve so that the arrow on it points towards the flow of water in discharge pipeline. Connect the discharge line to the overhead tank, on the other side of the pressure regulator valve. In horizontal sets, tighten the suction and pressure pipelines in the horizontal portion by twin clamp before starting. Give a proper support to the erector pipeline so that they do not give any pressure on the pump body. Screw down the pressure gauge to its thread in the pump casing/pressure regulator valve body.

6.4 Installation of Duplex Type Jet Pump

It shall be born in mind that in duplex jet pump, both outer and delivery pipe are screwed to jet assembly together and then lowered in the wall. The foot-valve of the duplex jet pump may be either external to the duplex assembly or internal within duplex assembly. The main components of a duplex type jet centrifugal pump combination are:

a) Centrifugal monopump/coupled/belt driven pump,

b) The jet pump assembly components:
    1) Duplex type jet pump assembly with foot-valve, strainer and duplex unit;
    2) Outer pipe flange;
    3) Duplex head/well adoptor;
    4) Flanges to connect pump and duplex; and
    5) Outer and inner pipe clamps.

c) Delivery assembly components:
    1) Pressure regulating valve,
    2) Priming unit,
    3) Pressure gauge,
    4) Air releasing cock, and
    5) Delivery flanges.

6.4.1 The installation of duplex type jet assembly with pipes and monopump is done in three phases.

a) Assembly of outer pipe and delivery pipe (inner pipe) to the duplex jet assembly,

b) Assembly of outer and inner pipe to the monopump through duplex head/well adopter through flanges, and

c) Assembly of discharge line.

6.4.2 *Assembly of Outer Pipe and Delivery Pipe to the Duplex Jet Assembly*

For ease of erection, the length of individual bits of pipes are generally kept less than three metres since both pipes are assembled together. Keep the length of the delivery pipe at least 3 m longer than outer pipe for easy tightening of the inner and outer pipe separately.

Check the duplex jet assembly for any damage in transit and blow air through the jet assembly so that no foreign particles have clogged the venturi or nozzle. If the footvalve forms an internal part of the jet assembly, fit a small column of inner pipe and pour water to check water tightness of seating of the footvalve.

If the footvalve is external, it should be only fitted after the assembly of first length of inner and outer pipe to jet assembly before lowering. Tighten the jet assembly with first bit of inner pipe with proper sealing compound. Above the duplex nut seating, place the gasket and place the first bit of the outer pipe and tighten both through outer pipe coupling using proper sealing compound.

Using one clamp on the outer pipe and one on the inner pipe, lower the pipes within the bore. Pour water within these pipes and check for any leakage. If both the inner and the outer pipes are lowered to the required length, fix a clamp on the outer pipe and house it on the well casing. Tighten the outer pipe flange using proper sealing compound to the outer pipe. It shall be seen that in this position, the inner pipe shall be protruding above the outer pipe flange by a length of at least duplex head height plus 50 mm.

6.4.3 *Assembly of Outer and Delivery Pipe to Monopump Through Duplex Head and Flanges*

The concentric flow areas between outer and inner (delivery) pipes are made twin flow areas by fitting a duplex head otherwise known as well adopter above the outer pipe flange. Place its gasket above the outer pipe flange and then mount the duplex head above it passing it above the inner pipe. In this condition, the inner pipe will be protruding above the duplex head top level by at least 40 to 50 mm. Cut the inner pipe using hacksaw to the top surface level of the duplex head. Clean out all the burrs around the inner pipe and insert the sealing ring rubber gland above the outside diameter of the inner pipe which will sit in its seating in this duplex head. Place its gasket above the duplex head. Now it is ready for connecting it with the monopump. Two sets of flanges, one for the duplex head and the other for the monopump shall be supplied. Connect these flanges using two elbows and the required length of pipes. A slip coupling shall be used for ease of erection in the pressure line. Using the gasket, tighten this assembly to the duplex head and to the monopump.

6.4.4 *Assembly of Discharge Pipeline to the Monopump*

Fit the discharge flange to the pump body using the rubber washer and wire gauge to avoid entry of foreign particles. To the delivery flange, using a nipple, tighten a T-coupling. To the top of the T-coupling, tighten the priming unit. To the other side, tighten the pressure regulating valve. Connect the delivery line to the overhead tank on the other side of the pressure regulating gate valve. Tighten the suction and pressure pipelines in the horizontal portion by a twin clamp before starting. Give proper support to the ejector pipeline so that they do not give any pressure on the pump body. Screw down the pressure gauge to its thread in the pump casing.

6.4.4.1 *Electrical connections*

Use proper capacity switch and starter with overload and under voltage protections. While giving connection, take care to avoid loose contacts. Do not use oversize fuse. Before starting, see that the motor runs in the correct direction as indicated by the arrow mark on the casing. In single phase jet pumps, test with a voltmeter to ensure that the line voltage does not go below 180 volts while starting the pump.

7 OPERATION

7.1 All the instructions laid down for centrifugal pump in IS 9694 (Part 3) : 1980 shall apply to the operation of jet centrifugal pump combination. Further, the following recommendations shall be followed.

7.1.1 After starting the pump, the pressure regulating valve/throttle valve shall be adjusted to a pressure which is 20 percent higher than the minimum operating pressure specified on the name plate. Pump shall be allowed to run at least for 3 to 4 hours and fall in operating pressure shall be recorded. Pressure regulating valve shall now be readjusted to the minimum operating pressure. Failure of the pump to operate at minimum operating pressure shall mean that the yield of well is lesser than the capacity of the pump. In such cases, readjust the pressure to a higher value so that the continuous flow of water is established. The failure of jet centrifugal pump combination to deliver water after starting may be due to the following additional factors:

a) Clogging of foreign particles in jet nozzle or venturi.

b) Foot valve strainer clogging due to mud in the well — It is recommended that footvalve shall be at least 2 m above the bottom most point of well in bore wells and at least 0·3 m above the bottom in open wells.

c) Inner changing pressure and delivery pipe.

d) Leaky joints of duplex nut.

e) Leaky joints of coupling in pressure and delivery pipes.

f) Damage of packer washers during erection in packer type jet pump.

8 MAINTENANCE

8.1 All the installations laid down for centrifugal pump in IS 9694 (Part 4) : 1980 shall apply for the maintenance of jet centrifugal pump combination.

9 SHIPMENT

9.1 IS 9694 (Part 2) : 1980 shall apply to the centrifugal pump part.

9.2 Jet Pump Assembly

a) All the important components, such as, venturi, nozzle, footvalve, etc, shall be clearly protected and covered from foreign particles entry.

b) The venturi and footvalve stem portion shall be thoroughly protected from damage due to accidental throwing of the packing.

c) Pressure gauge supplied with the pump shall be thoroughly protected from damages to the dial and the glass cover from shock.

ANNEX A

(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
IS 210 : 1978	Grey iron castings (*third revision*)
IS 318 : 1981	Leaded tin bronze ingots and castings (*second revision*)
IS 996 : 1979	Single phase small and universal electric motors (*second revision*)
IS 9694 (Part 2) : 1980	Code of practice for the selection, installation, operation and maintenance of horizontal centrifugal pumps for agriculture applications: Part 2 Installation
IS 9694 (Part 3) : 1980	Code of practice for the selection, installation, operation and maintenance of horizontal centrifugal pumps for agriculture applications : Part 3 Operation
IS 9694 (Part 4) : 1980	Code of practice for the selection, installation, operation and maintenance of horizontal centrifugal pumps for agriculture applications: Part 4 Maintenance
IS 11170 : 1985	Performance requirement constant speed compression ignition (diesel) engines for agricultural purposes
IS 12225 : 1987	Technical requirement for jet centrifugal pump combination

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